Claims

1. A method for refining microstructure of metallic materials, characterized in that comprises forming cavitation (cavities) in molten metal by the direct application of high-energy vibrating force such as electromagnetic vibrating force, ultrasonic vibrating force to the molten metal, crushing the resulting solid metal crystal particles into small pieces by the impact pressure generated during the collapse of the cavities, and yielding a refined microstructure thereof.

2. The method for refining microstructure of metallic materials according to Claim 1, wherein the high-energy vibrating force is applied during the solidification of said metal.

3. The method for refining microstructure of metallic materials according to Claim 1 or 2, wherein the high-energy vibrating force is applied to a metal in the process of solidification by the simultaneous imposition of an electric current and a magnetic field to said molten metal or solidifying metal.

4. A method for refining microstructure of metallic materials, characterized in that comprises forming cavitation (cavities) in molten metal by the direct

application of high-energy vibrating force such as electromagnetic vibrating force, ultrasonic vibrating force to the molt n metal, crushing solid particles of other metals, intermetallic compounds, or the like dispersed in the molten metal as well as the solid metal formed during solidification into small pieces by the impact pressure generated during the collapse of the cavities, and yielding refined microstructure thereof.

5. A method for refining microstructure of metallic materials, characterized in that comprises forming cavitation (cavities) in molten metal by the direct application of high-energy vibrating force such as electromagnetic vibrating force, ultrasonic vibrating force to the molten metal, crushing the solid particulate ceramics or other nonmetals dispersed in the molten metal as well as the solid metal formed during solidification into small pieces by the impact pressure generated during the collapse of the cavities, and yielding refined microstructure thereof.

6. A method for refining solid metal particles formed during solidification to move them to a prescribed location by the simultaneous imposition of an electric current and a magnetic field on the molten metal in the process of final solidification.

7. The method according to Claim 6, wherein the solid metal particles formed during solidification are refined to shift them to a periphery of a tube by the simultaneous imposition of an electric current and a magnetic field on the molten metal in the process of final solidification.

8. The method according to Claim 6, wherein the solid particles of other metals, intermetallic compounds, or the like dispersed in molten metal as well as solid metal particles formed during solidification are refined to shift them to a periphery of a tube by the simultaneous imposition of an electric current and a magnetic field on the molten metal in the process of final solidification.

9. The method according to Claim 6, wherein the solid particulate ceramics or other nonmetals dispersed in molten metal as well as solid metal particles formed during solidification are refined to shift them to a periphery of a tube by the simultaneous imposition of an electric current and a magnetic field on the molten metal in the process of final solidification.

10. The method according to Claim 6, wherein the solid particles dispersed in molten metal are refined to move them to a location separated from the location of

the initial dispersed state by the simultaneous imposition of an electric current and a magnetic field.

add A4 B1